Adoption of E20 Fuel and Green Hydrogen Production

For Prelims: E20, Ethanol Blending, National Green Hydrogen Mission, G20 presidency, Nitrous oxides, Green hydrogen, International Energy Agency, Renewable energy, Carbon emissions.

For Mains: Applications of Green Hydrogen, Advantages of Ethanol Blending.

Why in News?

In a recent announcement, the Union Minister of Petroleum and Natural Gas, highlighted that **petrol blended with 20% ethanol, known as E20**, will soon be available at **1,000 outlets of oil marketing companies (OMCs) nationwide.**

- The **National Green Hydrogen Mission** aim to achieve a production capacity of **5 Million Metric Tonnes (MMT) per annum by 2030**, was also highlighted.

What is Ethanol Blending and E20 Fuel?

- **About:**
  - **Ethanol is an agricultural by-product which is mainly obtained from the processing of sugar from sugarcane,** but also from other sources such as rice husk or maize.
    - **Blending ethanol with petrol to burn less fossil fuel while running vehicles** is called **Ethanol Blending.**
    - **E20 fuel is a blend of 20% ethanol and 80% petrol.** The E20 was launched by the **Prime Minister of India in February 2023 in Bengaluru.** This pilot covers at least 15 cities and will be rolled out across the country in a phased manner.
  - India has been increasing **its ethanol blending in petrol from 1.53% in 2013-14 to 10.17% in 2022**.
    - The government has advanced its target to achieve 20% ethanol blending in petrol **from 2030 to 2025.**
    - During our **G20 presidency**, the government has also proposed to launch a **global biofuel alliance with countries like Brazil** to promote biofuels internationally.
- **Advantages:**
  - E20 fuel has several advantages over conventional petrol, such as:
    - It **reduces vehicular tailpipe emissions** by lowering the carbon monoxide, hydrocarbons and nitrogen oxides levels.
    - It **improves engine performance and reduces maintenance costs** by preventing corrosion and deposits.
    - It **reduces the import bill for crude oil** by substituting domestic ethanol production.
      - It is estimated that a **5% blending (105 crore litres)** can result in replacement of **around 1.8 million barrels of crude oil.**
      - India imported 185 million tonnes of petroleum at a cost of USD 551 billion in 2020-21. A successful E20 programme **can save the country USD 4**

billion or Rs 30,000 crore per annum.
- It **supports the farmers and rural economy** by creating demand for surplus crops.

- **Challenges:**
  - **Shift Towards Sugarcane Production:** In order to achieve a 20% blend rate, almost **one-tenth of the existing net sown area will have to be diverted for sugarcane production.**
    - Any such land requirement is likely to put a **stress on other crops and has the potential to increase food prices.**
  - **Storage Constraint:** Annual capacity of required bio-refineries is stipulated to be **300-400 million litres,** which is still not enough to meet the 5% petrol-ethanol blending requirement.
    - Storage is going to be the main concern, **for if E10 supply has to continue in tandem with E20 supply,** storage would have to be separate which then raises costs.

What is Green Hydrogen?

- **About:**
  - **Green hydrogen** is hydrogen produced by **electrolysis of water using renewable or green energy.**
  - It is considered the **cleanest form of energy, as it does not emit any greenhouse gases when used.**
    - India has the potential to become a leader and a superpower in green hydrogen production, **according to the International Energy Agency (IEA)**.
      - India has abundant renewable capacity, especially solar power, which can be used to produce green hydrogen at low cost.
    - India has also set a target of producing **5 million metric tonnes of green hydrogen per annum by 2025-26 under its National Hydrogen Mission.**
    - The **private sector is also actively engaged in pursuing green hydrogen production** and has attracted significant investment from international sources.
- **Applications:**
  - **Decarbonizing Energy Systems:** Green hydrogen can be used as a clean energy carrier and stored for later use.
    - It can be utilised in sectors such as **power generation, heating, and transportation to replace fossil fuels**, thereby reducing **carbon emissions**.
  - **Production of Green Ammonia:** Green hydrogen has the potential to replace **traditional fertilisers in agriculture through the production of ammonia using renewable energy sources.**
    - Green ammonia produced with help of green hydrogen is carbon-free, it has other benefits **over traditional fertilisers, including improved efficiency and reduced soil acidity.**
  - **Off-Grid and Remote Power Generation:** Green hydrogen can provide reliable and clean power in **off-grid or remote locations where access to electricity is limited.**
    - It can be used in **fuel cells or combustion engines** to generate electricity for communities, industries, and infrastructure.
- **Challenges:**
  - **Cost:** Currently, the **production of green hydrogen is more expensive compared to hydrogen produced from fossil fuels through steam methane reforming.**
    - The high cost is primarily due to the capital investment required for renewable energy infrastructure.
  - **Scale and Infrastructure:** Establishing a comprehensive green hydrogen infrastructure, including **production, storage, and transportation, is a significant challenge.**
    - Scaling up production capacity and building a distribution network for hydrogen require substantial investments.
    - Additionally, **retrofitting existing infrastructure or creating new pipelines, storage facilities, and refuelling stations adds to the complexity and cost.**
    - **Impact on Resources:** About **9 kilograms (kg) of water** is required per kg of hydrogen.

        - The **production of green hydrogen requires vast amounts of resources: land, water, and renewable energy.** This can fuel land-use and water conflicts, human rights violations, energy poverty, and the delay of the de-carbonisation of the electricity grid in producer countries
    - **Energy Efficiency:** The process of electrolysis requires large amounts of electricity to split water into hydrogen and oxygen.
        - While **renewable energy sources can provide a clean electricity input,** the overall energy efficiency of the process is relatively low.

Way Forward

- **Policy and Regulatory Framework:** India needs to **formulate and implement supportive policies that provide incentives for ethanol production,** blending, and use, as well as promote the development of green hydrogen.
    - This includes **setting blending mandates, ensuring a favourable pricing framework, and establishing quality standards for both E20 and Green Hydrogen.**
- **Technological Advancements:** In the case of E20, advanced blending technologies, such as **flex-fuel engines and compatible fuel systems,** need to be developed and made widely available.
    - For Green Hydrogen, the **advancement of electrolyzer technologies,** storage systems, and efficient conversion processes is crucial to drive down costs and improve efficiency.
- **Public Awareness and Acceptance:** Public awareness and acceptance play a significant role in the successful adoption of E20 and Green Hydrogen.
    - Raising awareness about the benefits of these alternatives, addressing concerns related to **fuel efficiency, performance, and compatibility,** and promoting the environmental advantages are essential.
    - **Educating consumers, industry stakeholders, and policymakers** about the potential of these solutions and their contribution to decarbonization can drive acceptance and demand.

UPSC Civil Services Examination, Previous Year Questions (PYQ)

Q. Given below are the names of four energy crops. Which one of them can be cultivated for ethanol? (2010)

(a) Jatropha
(b) Maize
(c) Pongamia
(d) Sunflower

Ans: (b)

Q. According to India's National Policy on Biofuels, which of the following can be used as raw materials for the production of biofuels? (2020)

1. Cassava
2. Damaged wheat grains
3. Groundnut seeds
4. Horse gram
5. Rotten potatoes
6. Sugar beet

Select the correct answer using the code given below:

(a) 1, 2, 5 and 6 only
(b) 1, 3, 4 and 6 only
(c) 2, 3, 4 and 5 only
(d) 1, 2, 3, 4, 5 and 6

Ans: (a)

Q. Consider the following heavy industries: (2023)

1. Fertiliser plants
2. Oil refineries
3. Steel plants

Green hydrogen is expected to play a significant role in decarbonizing how many of the above industries?

(a) Only one
(b) Only two
(c) All three
(d) None

Ans: (c)

Source: DTE